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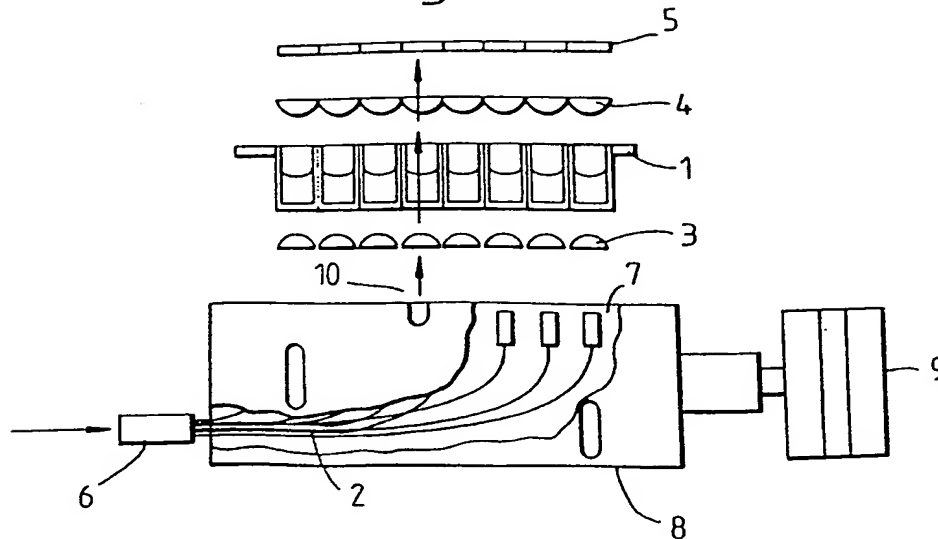
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US 4004150 A

(58) Field of search  
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INT CL<sup>5</sup> G01N

(54) Directing light through cuvettes

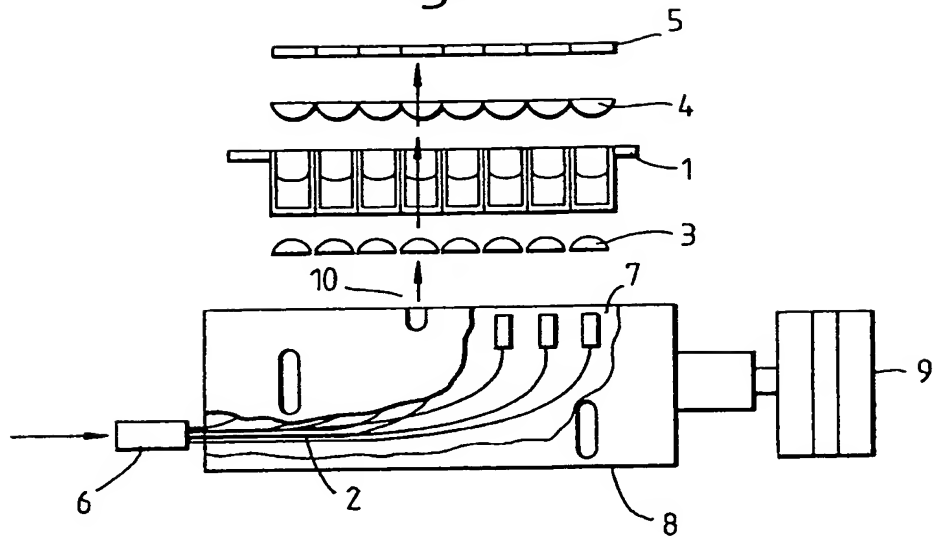
(57) Light is directed in turn through each cuvette of a row of cuvettes (1) in a photometer having photodetectors (5). Onto each cuvette in the row, light is successively conducted through a rotating cylinder or disc (8), which is provided with a slot (10) for each light path. The slots allow light conducted through optical fibres (2) to reach the cuvettes for equal periods of time. The slots are staggered so that successively illuminated cuvettes are as far apart as possible so that stray light passing through the adjacent cuvette does not disturb the measurement.

Fig.1.

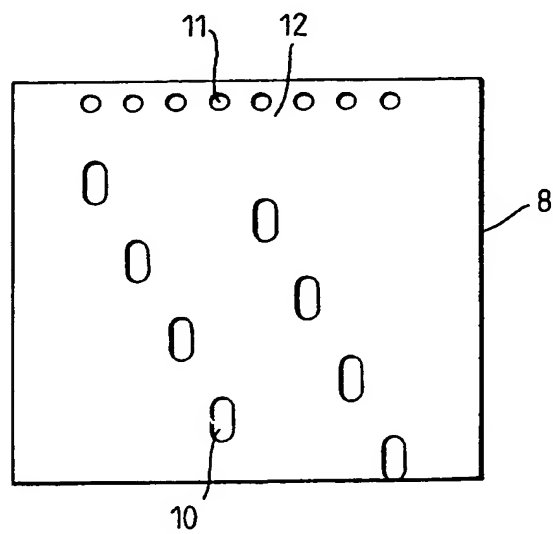


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*Fig. 1.*



*Fig. 2.*



## METHOD FOR CONDUCTING LIGHT

The invention relates to photometers where the amount of light passing through cuvettes arranged in a row is measured. In particular the invention relates to the distribution of light in the cuvettes.

In the prior art there are known photometers, particularly designed to be used in clinical analyses, where the samples under measurement are placed in a matrix-form cuvette assembly comprising 8 x 12 cuvettes, which is made of transparent plastic throughout. The absorbence is measured row by row, so that from a common light source, light is conducted via separate light paths to each cuvette, and further to respective detectors.

A problem in the above described apparatuses is that the light emissions passing through adjacent channels disturb each other in the measurement.

The main object of the present invention is to solve the said problem. This is achieved by means of the methods described in the appended patent claims.

In the drawings of the specification, figure 1 illustrates an arrangement for conducting light through the cuvette assembly, and figure 2 illustrates the light distribution disc to be employed in the arrangement.

The arrangement of the drawings is carried out in an 8-channel photometer, where the employed cuvette assembly can be a regular 8 x 12 microtitration plate. When carrying out the measurement, a row 1 of eight cuvettes is brought to the measuring position, where light is conducted by means of light fibers 2, through lower lenses 3, to each cuvette from below. Above the cuvettes, the light that has passed through each cuvette is collected, by means of upper lenses 4, to detectors 5. The first ends of the fibers 2 are collected by an input collar 6 to form a beam of rays, whereto the emission from the light source is conducted. From each fiber, the light passes through a collar 7 vertically upwards

to each cuvette.

The outlet collars 7 of the fibers 2 are located inside a horizontal cylinder 8, which is open at one end. The cylinder is made of some material impermeable to light. The cylinder is rotated at an even velocity by means of a motor 9. In the cylinder barrel, there is made a slot 10, parallel to the barrel circumference, at each outlet collar. Thus light is emitted onto the cuvette only when the slot corresponding to the cuvette in question is located at the respective outlet collar. The length of the slot, and the speed of rotation of the cylinder, are so matched that light is emitted onto the cuvette for the duration required by the measurement.

The slots 10 are located on the cylinder barrel in succession, with even intervals, so that light is essentially emitted only on one cuvette at a time. This prevents the light scattered from the measuring beam of one cuvette from disturbing the measurement of another cuvette. Moreover, the slots are placed so that successive emissions of light fall on cuvettes that are located as far as possible from each other. Thus successive measurements can, in order to save time, be somewhat overlapping (for instance about 10% of the measuring period of each cuvette) without remarkable errors being caused by scattered light. The time used in the measurement of one plate (transmissions included) is typically about 5.5 s.

Moreover, the cylinder is provided with holes 11 for each cuvette, these holes being placed in a straight row. The holes are meant to be used particularly in the measurement of agglutinations, in which case the measuring beam is allowed to scan over the bottom by moving the cuvette assembly.

Further, the cylinder comprises an area 12 for defining the signal obtained from the detectors in cases where no light enters the cuvette.

The apparatus is synchronized so that when, after the measurement of one row 1 on the plate, the next row is shifted to the measuring position, the cylinder 8 makes one

revolution.

In principle the measurement can also be carried out without stopping the cuvette assembly. In that case, however, measuring accuracy is reduced owing to the vibration of the liquid surface.

Instead of a rotating cylinder, there can be employed a rectangular disc moving with respect to the cuvette assembly; or a disc rotating underneath an immobile cuvette assembly, in which disc the light-permeable slots are formed.

## CLAIMS

1. A method for conducting measuring light onto cuvettes arranged in a row in a photometer, where the light emitted from a light source is conducted, via separate light paths and for given durations, to each cuvette in the row, and at the same time the light passing through each cuvette is detected by a respective detector in order to measure the absorbence, c h a r a c t e r i z e d in that to each cuvette in the row, light is conducted in succession, at even intervals; and that the light is conducted onto the cuvettes through a light-cutting disc movable with respect to the light paths, which disc is provided with a slot at each light path, the slots being parallel to the motional direction of the disc, so that the measuring light is emitted on the cuvette only when the said slot is located at the light path.

2. The method of claim 1, c h a r a c t e r i z e d in that light is conducted essentially to one cuvette of the row at a time.

3. The method of claim 1 or 2, c h a r a c t e r i z e d in that light is conducted successively onto cuvettes which are located as far as possible from each other.

4. An apparatus for conducting measuring light onto cuvettes arranged in a row in a photometer comprising a light source; a separate light path for each cuvette in the row, for conducting light from the light source onto the cuvette; and a detector for detecting the light passing through the cuvette, c h a r a c t e r i z e d in that the apparatus is provided with a light-cutting disc (8) for interrupting the light paths, which disc is movable across the light paths, in relation to them, and is provided with a slot (10), parallel to the motional direction of the disc, in order to conduct light through the disc onto each cuvette in succession for equal periods of time.

5. The apparatus of claim 4 in a photometer, where each light path includes an optical fiber for conducting the light from the light source onto the cuvette, c h a r a c t e -

r i z e d in that the light-cutting disc (8) is located in between the further ends of the optical fibers and the cuvettes.

6. The apparatus of claim 4 or 5, c h a r a c t e r i - z e d in that the light-cutting disc (8) is a cylinder.

7. The apparatus of any of the claims 4 - 6, c h a - r a c t e r i z e d in that the light-cutting disc is provided with a number of holes (11) for conducting light onto all cuvettes simultaneously.

8. The apparatus of any of the claims 4 - 7, c h a - r a c t e r i z e d in that the light-cutting disc includes a non-transparent area for preventing the light to be conducted on all cuvettes.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number  
 9122870.0

**Relevant Technical fields**

(i) UK CI (Edition K ) G1A (ACD, ADJ, ARN, ATA, ATH)

(ii) Int CI (Edition 5 ) G01N

**Search Examiner**

R S CLARK

**Databases (see over)**

(i) UK Patent Office

(ii)

**Date of Search**

16 JANUARY 1992

Documents considered relevant following a search in respect of claims 1 AND 4

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1340811 DAMON CORP - line 8 page 4 to line 64 page 5	1, 4
X	GB 1192008 UKAEA - line 86 page 2 to line 61 page 3	1, 2, 4, 6, 8
X	EP 0062160 A1 BOEHRINGER INGLEHEIM - whole document	1, 2, 4, 5
X	US 4004150 NATELSON - column 3	1, 2, 4, 8



Category	Identity of document and relevant passages	Relevant to claim(s)

#### Categories of documents

**X:** Document indicating lack of novelty or of inventive step.

**Y:** Document indicating lack of inventive step if combined with one or more other documents of the same category.

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